DISPLAY DEVICE SUITED FOR A BLIND PERSON

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims benefit of priority under 35 USC § 119 to German Patent Application No. 100 42 949.1, filed Aug. 30, 2000 and German Patent Application No. 100 42 950.5, filed Aug. 30, 2000, the entire contents of which are incorporated by reference herein.

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates to a display device which is especially suited for blind persons. In order to enable blind persons to also be able to read, the so-called Braille system of writing was developed where figures and numbers are represented as coded patterns. Small stampings for example on coins or in a book are tangible for blind persons and can consequently be comprehended. With special typewriters for the blind, individually written characters are first integrated in a line before a perforation or stamping of a substrate, which as a rule consists of paper, takes place.

In the meantime, with an almost complete permeation of the working world by electronic devices such as computers, blind persons are constantly confronted with the problem of not being able to comprehend the content on video screens. Particularly, FIGS. and numbers can be communicated through Braille in connection with the use of special accessory devices, but graphic representations, such as, for example, diagrams or tables, are now as before incomprehensible and cannot be inputted.

In addition, it is not possible to communicate to a blind person an image of their environment by means of Braille since this too requires a graphic representation.

SUMMARY OF THE INVENTION

One objective of the present invention is thus to propose a display device that makes it possible to make electronic image information normally represented on a video screen and comprehensible through the human sense of vision or the image of the environment comprehensible for the blind as well.

The objective is accomplished by a display device with a large number of areally arranged elements, i.e., elements arranged in an area of a surface on the device, preferably a substantially flat surface, which can be actuated individually, and an actuation device for actuation elements, whereby electronic image information fed to the actuation device is tangibly represented through the elements. Moreover the objective is accomplished through a display device with a large number of actuator elements areally arranged on a flexible substrate which are individually actuatable, whereby vibrations and/or heat and/or electrical impulses can be generated through the actuator elements.

The mode of operation of the actuator device is based upon the physiological fact that the finger pads and other specific skin regions react especially sensitively to microvibrations and heat. The scanned results are retained in short term memory owing to which, after a learning phase, the possibility arises of compiling an overall image of the individual readings in the brain. A flexible execution of a display device of the invention can be installed on unobtrusive places on the skin, and it is particularly suitable if, for

orientation in an unfamiliar environment, a display apparatus should be carried along for a mobile orientation system.

Advantageously, the elements are arranged in a matrix. Even complex graphic image information can be represented comprehensively or tangibly through small matrix elements with a corresponding size of the overall matrix. In various configurations of the invention, the elements generate vibration, heat or electrical impulses, for example microdischarges. In a further improvement, the frequency of the vibrations can be controlled in an especially advantageous configuration, representation possibilities are combined. In this way, additional information, for example the three dimensional properties of the objects represented or color differences can be represented. Making an input possible through an input device with a great number of areally arranged sensor elements, which are individually readable, and an evaluation device for evaluating the information of the scanned sensor elements is advantageous, whereby through the input device, an image generated by mechanical contact with the sensor elements is convertible into electronic image information. Sensor elements are in this way simply realized in that the matrix elements are additionally outfitted with sensory properties.

In a configuration especially advantageous for work with computers, the display device is supplemented with a sign input device which consists of a known Braille system input unit, a loudspeaker and function keys. When using the display device as an electronic book, the display device is provided with a read-in device which can read in conventional books through a camera or for example a scanner. Furthermore, it is possible to provide a device for reading in electronic data carriers, for example diskettes or CD ROMs. By supplementation with further functional units, the display device can be operated as an independent system.

Another special read in device is to be designed for receiving image information from the environment. By a combination with an image recognition system and a flexible construction of a display device of the invention, a portable orientation system is realizable.

In constructing the display device with a flexible substrate, the display device can be positioned at the most varied of sites, for example, unobtrusively on the back, the neck or on the forehead. There specially designed caps, hats or headbands are conceivable, whereby the display device fastened thereupon lies directly on the forehead. Since the display device constantly lies on the skin, it is advantageous if a skin tolerable material is selected as a substrate material, for example medical silicon. If the casing of the actuator elements is constructed suction cup-like, an especially good contact between the actuator elements and the skin arises owing to the suction on the skin, and therefore an especially good perception.

A display device of the invention is advantageously worn on a part of the body at which the density of nerve endings is as great as possible. In any case, it makes no sense to arrange a display device with a high resolution on a site on the body with a low number of nerve endings.

Further particularities and configurations of the invention are indicated in the description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein: